GNG2101

Project Deliverable D

Group 1.3

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1 Introduction

In this deliverable, our updated detailed design demonstrates some design improvements based on feedback received from the client. The design addressed some design flaws in the previous iteration that lacked the necessary specifications. As the development of the first prototype is on the way, we have included a time estimate and necessary skills and resources needed to successfully implement this design, in addition to some critical product assumptions that need to be kept in mind. Also, a bill of materials was compiled to present the components needed to assemble the first prototype.

2 Client Meet Feedback

General Feedback:

- It looks like it could possible be complex and expensive
- Its flexible and portable with the wheelchair
- At the moment, the more severe the disability, the more expensive and hard to find. Want devices that are available to a larger demographic.
- Rebecca, our client, currently owns a Permobil power wheelchair (has a lot of parts that can change with allen key, versatile). Can also look at Quickie power wheelchairs.

Feedback	Our response to feedback
Bob wants the Laddalift or a design with a step ladder. It could be dual purpose, affordable, and stackable.	The team has decided that we will not be pursuing the LaddaLift design, but focus on Rebecca's approval on the slide device due to time and budget constraints.
-Want to be usable for people who don't use wheelchairs as well. Current prototype needs the stability of a wheelchair to lift a heavy person up. -Need to think about the level/range of disability to focus on. Add to the design criteria. (for example: usable for person with one arm, two arms, needs 1 worker to help, completely paralyzed, or paralysed on one side)	-The level of disability will allow people with limited mobility and low core strength to use the device as long as one caregiver is around to help set up the device. -We have defined that the device must be used with one other person to help regardless of the level of mobility the user has.

How does it inflate and deflate?	The team has decided to take a pause on the inflatable chair and focus on the winch design, due to some difficulties with determining the budget and technical requirements to have an inflatable component.
-The wheel and the bottom of the wheelchair will get in the way so we need to find a way to lift a person up (maybe at an angle?) -Check that it will fulfill the floor to seat height standards for wheelchairs	-We will be using a slide against the wheelchair. -The slide will respect the floor to seat height and have a vertical height of 19”.
Would need power from a power wheelchair. Need to look into the editions of power wheelchairs.	We will be focusing on the power wheelchairs mentioned by Rebecca, the wheelchairs from Permobil and Quickie. They are mostly equipped with a 12V battery so we will assume this battery voltage for our design.
Maybe needs transfer board for the power wheelchair?	Instead of a transfer board, we will use a slide with a smooth surface to transfer the user to a wheelchair.

3 Updated Detailed Design

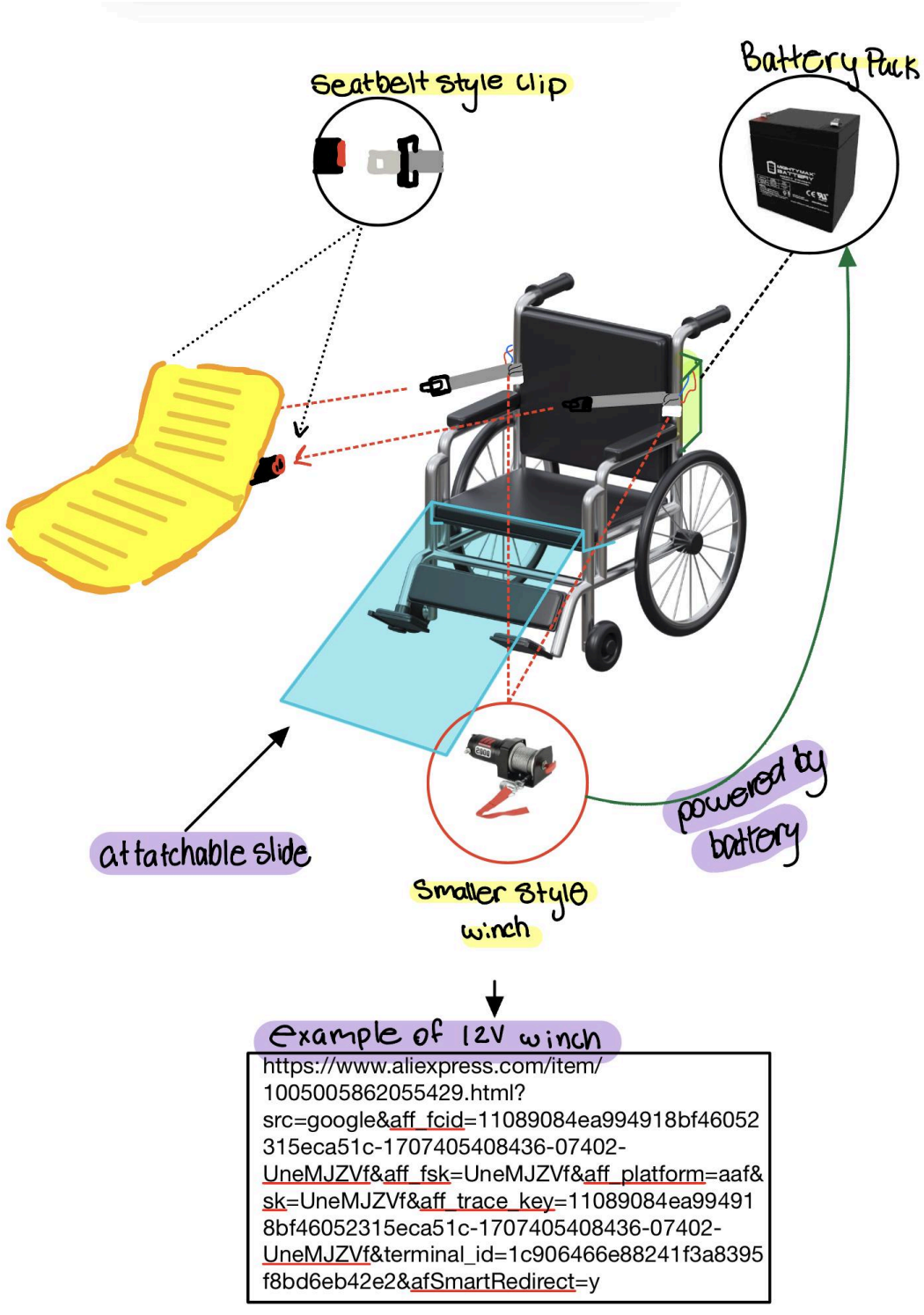


Figure 1: Rough idea of the global design

Inflatable chair example:

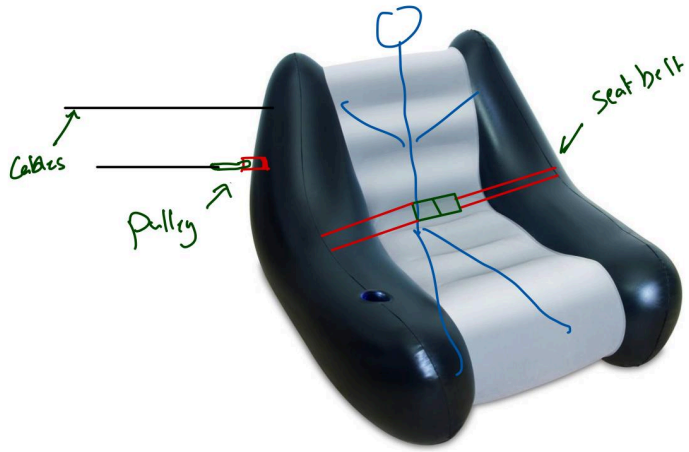
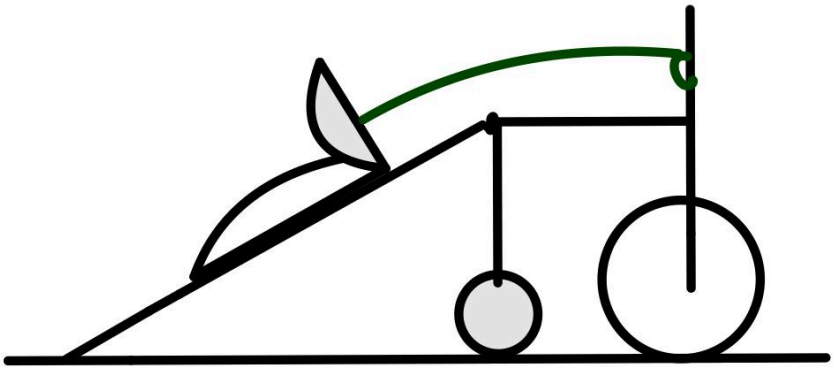


Figure 2: chair example with the strap system

The chair is meant to have one strap at the front for safety and two at the back so it could be attached to the two pulleys.

How the concept works:



How the product is intended to work is as follows:

When a person in an electric wheelchair falls off, the caregiver will place the slide in front of the electric chair and place the impaired person on an inflatable chair while it is deflated for simplicity. Then after inflating the chair and buckling the belt on the person, the caregiver will

proceed to turn on. The pulleys will start to pull the person up the slope till they reach the chair and deflate to maintain comfort for the person.

4 Skills and Resources to Complete Design

- We have access to all the STEM labs, machines, and MakerSpace
- We can consult the TA's specific to our class and TA's outside of our class that are available to answer our questions
- Consult Professors that may have specialized knowledge and information on the topic of interest
- Members in our team who are familiar with designing software like CAD modeling and SolidWorks
- Artistic skills
- Frequent question and communication with the client
- Ask Alex (the maker space person) for any inquiries regarding assembling/manufacturing pieces
- Factor in external purchases into the design (e.g. winch/pulley, possibly inflatable chair)
- Strongly keep in mind the client feedback and put in effort to incorporate/include all the required updates.
- We are going to continue following our Gantt charts to ensure remaining on task and in order to prevent slacking.

5 Missing skills:

- Most team members have minimal to no experience with coding.
    - How we'll make up for it is by using online resources to help with the process when needed, and asking professors in the university for assistance when needed.
- A lack of knowledge of material sciences.
    - Will use online resources and check with Alex if it would work.
- Generic experience with electric circuits.
    - Use online simulations and trial and error
- A lack of knowledge on the wheelchairs used.
    - We did extra research and met up with the client's Daughter to inspect an electric wheelchair in person.
- Risk Management skills.
    - We have to be very mindful regarding the safety of the product, this will be done by regularly checking with Alex to ensure the logistics of what we are trying to do makes sense.

6 Time Estimate to Implement design

The design process of the product will unfold progressively. The final design will be fully ready after the third prototype is achieved. It is anticipated that the third prototype will be fully prepared by the third week of March. This timeframe allows ample room for the comprehensive implementation of the insights gained throughout the development of our three prototypes. The final product will therefore have to be ready at the beginning of April, but before design day, which is anticipated to be during the second week of April. This makes the required time of the design to be approximately 2 weeks. The group and every individual of the group is willing to put forth 4-6 hours per week of work, to accomplish the full design.

7 Critical Product Assumptions

- Device user is <300lbs
    - Client weight requirement and to make sure the winch is capable of lifting the weight.
- The chair is an electric wheelchair
    - Because the level of disability we are targeting tends to use a powered wheelchair and our design relies heavily on the wheelchair weight to be able to pull a person up. Also, we are planning to use a powered winch that will be powered using the wheelchair battery.
- There is at least one caregiver or helper around to assist in the process.
    - Since the slide will not be permanently attached to the chair a caregiver must be around to bring the slide to the fallen person
- The wheelchair is powered by a 12V battery
    - Most powered wheelchairs have a 12V battery that we will use to power the winch.
- The power wheelchair is 300lbs
    - Since every wheelchair is different we decided to go with the client's wheelchair which is 300lbs.

8 BOM

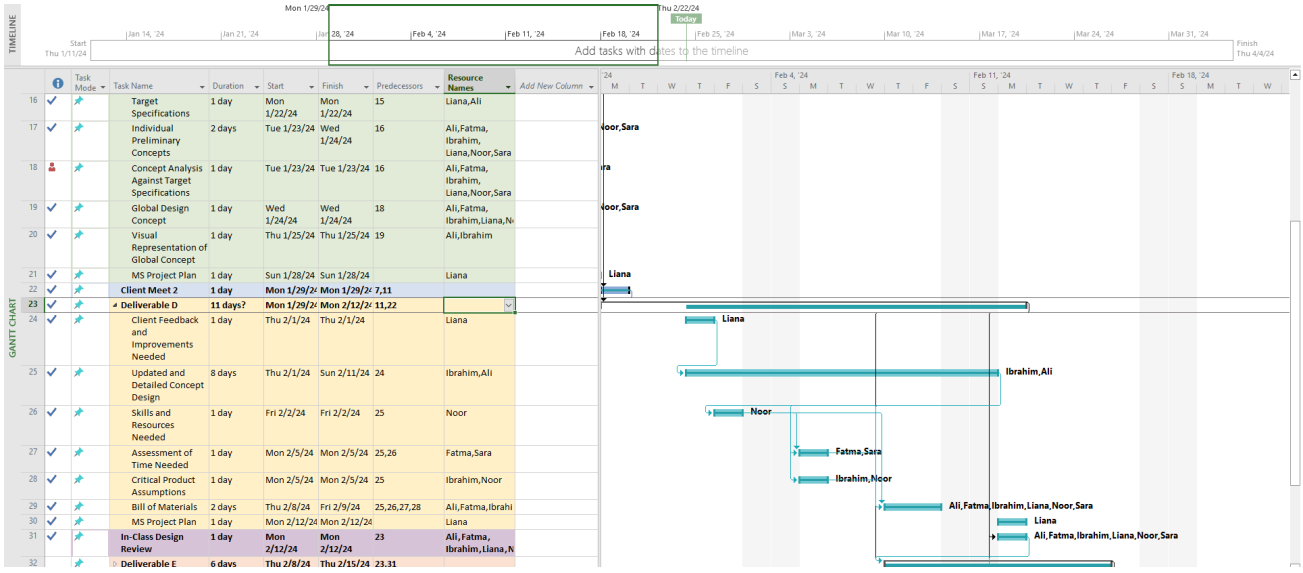
Sub-System	Item	Description	Unit of measure	Quantity	Unit Cost	Total Cost	Link/Where to Obtain
Slide	Wooden Planks	To make slide component (used for demonstration purposes, preferably made of plastic)	# of units	4	$0.00		Brunsfield
	Vinyl Sheet	To smooth out and reduce friction on wood	m	N/A	N/A		don't need for the first prototype, TBD at a later time
	Screws	To screw the wood together and possibly hinges onto wood	# of units	10	$0.00		Brunsfield
	Hinges (TBD)	Based on feedback from 3rd client meeting, possibly make slide foldable using hinges	# of units	N/A	N/A		don't need for the first prototype, TBD at a later time
Headrest Attachment	Solidworks	To model the attachment	N/A	N/A	$0.00		Uottawa vmware server
	3D Printer	To print out attachment (The reason for 3D printing is bc the part will be	N/A	N/A	$0.00		Makerspace

		customized to the one wheelchair we have dimensioned)					
	Sand Paper	To smooth out 3D printed part	grit	2	$0.00		makerspace
Winches	Winches	To pull weight up the slide onto wheelchair	m	2	$24.56	$55.51	Amazon
	Square Metal Bar	To connect 3D printed part to the winches and to extend outward on both side for winch	m	1	$1.00	$1.00	https://makerstore.ca/shop/ols/products/metal-bars-brunsfield
	Screws, brackets, clamp	To mount winches to metal bar and 3D printed part (this will not be structurally secure due to weak 3D printed part, but used for demonstration purposes of final prototype)	# of units	10	$0.00		Brunsfield
	Adhesive or cable ties	Possibly needed to secure the attachments together	# of units		$0.00		Makerspace or from home
	6-pin power	To connect	v	N/A	N/A		N/A

	connector/adapter	winches to power source on wheelchair					
	Wiring/Adaptors	Possibly needed to make sure the 6 pin power adaptor is compatible with winch and battery, if not need adaptor	v	N/A	N/A		N/A
General	Drill	Used to drill holes in 3D printed part that match the headrest holes to fasten part to headrest	N/A	1	$0.00		makerspace
		Used for the metal bar that holds the winches					
		To screw the slide together					
	Saw	To cut wood	N/A	1	$0.00		Makerspace
	Screwdriver/ Wrench	For building prototype	N/A		$0.00		Makerspace
Sum of cost						$56.51	
SUM OF COST FOR 1ST PROTOTYPE						$27.75	

9 Gantt Chart Update

Deliverable D Update:



PDF Snapshot of Full Gantt Chart:
https://drive.google.com/file/d/1gUr0HmzGZPtSwMa4yDj9e4ADhRCOPQ6H/view?usp=drive_link